

THE UTILIZATION OF HOVERCRAFT IN ARCTIC AND SUB-ARCTIC REGIONS

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From an article in the January 1967 issue of "Polar Record" by
P.L. Black, of the RCAP, the project officer on airborn Hovercraft
trials.

"The experience of these trials has demonstrated that
proposed air lift equipment should be capable of
winter travel in arctic regions. In the western Arctic
coast of Canada, the western shores of Hudson Bay,
and the western part of Canada's Arctic archipelago."

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GENERAL INFORMATION

Requirements for a mode of transport offering the unique advantages of Hovercraft is increasing rapidly as northern regions of Canada and the State of Alaska are the scene of extensive mineral and oil exploration and associated support activities.

Present active operations indicate the suitability of Hovercraft on passenger and cargo routes over water. Trials over a three year period in Northern Canada and Scandinavian countries show that the craft is equally effective over ice, snow, tundra and similar terrain. Specific benefits available through utilizing Hovercraft can be noted below, see Operating Capabilities. General support of the craft in northern areas can be seen from the following excerpts:

- 1) From a report entitled "The North" by editor Irwin Wolfe in the publication "Canadian Transportation".

"--- Canada's vast northern properties, containing a vast treasure-chest of minerals and the potential of new population centres has been effectively sealed to us by lack of transport more than it has by its forbidding climate "

- 2) From a report by the Defence Research Board entitled "Trials of SR-N5 Hovercraft in Northern Canada".

" In general the Hovercraft could negotiate all surface conditions encountered in these trials. It has been shown that Hovercraft have considerable potential as a transport medium in northern Canada. "

" Of all the vehicles being developed and already developed for transportation in the north, the Hovercraft must be put at the head of the list for practicability and chances of success. "

- 3) From an article in the January 1967 issue of "Polar Record" by F/L Storr, of the RCAF, the project officer on airforce Hovercraft trials.

" The experience of these trials has demonstrated that present day air cushion vehicles should be capable of winter travel in regions similar to the western Arctic coast of Canada, the western shores of Hudson' Bay, and the western part of Canada's Arctic archipelago. "

The requirements of transportation in northern areas include the need to travel over water, ice, snow, muskeg, tundra and combinations of these conditions during winter and summer months. Only the Hovercraft can adequately meet these requirements. The craft can readily travel over any surface having a relatively flat environment and can ascend a 12 to 15 degree incline from a static position. It can climb steeper slopes if forward speed is maintained prior to reaching an incline and is able to pass over obstacles and crevices.

Speeds, useful loads, passenger capacity and varied operating configurations enable a user to economically support prime roles throughout the year by utilizing the Hovercraft.

OPERATING CAPABILITIES

The SRN-6 Hovercraft provides a user with unique operating capabilities as follows:

<u>Speed:</u>	Calm Water	56 knots
(Maximum Continuous)	2' sea condition	48 knots
	5' sea condition	38 knots
	8' sea condition	30 knots
	Smooth ice	64 knots
	Flat snow	62 knots
	Rolling, 3', snow	45 knots
	Flat soil	60 knots
	Rolling, 3', soil	43 knots

<u>Range/Endurance:</u>	Standard @ 50 knots	3.8 hours
(Normal Operating)		190 n.m.
	Long range tanks @	
	50 knots	6.9 hours
		345 n.m.

<u>Cold Weather Limits:</u>	Standard heater, cabin temp, effective to 0° F.
	Auxilliary heater, cabin temp., effective to 40° F.
	Starting no problem to 20° F.
	Starting with external heat no problem to 40° F.
	Rubber skirts no problem to 20° F.
	Rubber skirts with external heat no problem to 40° F.

<u>Configurations:</u>	Outside stowage in aft cabin section with canvas cover, Note page 5.
	Single liquid cargo container in aft section of cabin loaded from the top, Note page 6.
	Complete cabin to house up to seven men inside cabin including cooking and water, Note page 7.
	One or more containers in aft section of cabin loaded from the top, Note page 8.
	Outside cargo space along side of craft for enclosed and lengthy cargo, Note page 9.

COST: Charges for Hovercraft vary dependant upon the length of a charter, the number of hours of utilization, the configuration required and the ferry and positioning distance. Basic charges are as follows:

Type of Craft	Hourly Rate	1, 2, & 3 Month Rate	4 & 5 Month Rate	6 to 12 Month Rate	Daily Minimum Charge
SRN-6 *	\$ 325.00	\$ 310.00	\$ 295.00	\$ 280.00	3 hours
SRN-5 **	315.00	300.00	285.00	270.00	3 hours

* See page 17

** See page 18

Ferry and positioning charges are calculated on the number of operating hours required to drive the craft to the job location times the applicable charter rate and/or the shipping cost of moving the craft by other than its own power.

All charges are based on the carrier, our company, providing fuel and oil. If fuel and oil is supplied by the charterer hourly charges are reduced by \$ 30.00 per hour but should the carrier's fuel costs exceed that sum all additional actual costs are paid by the charterer.

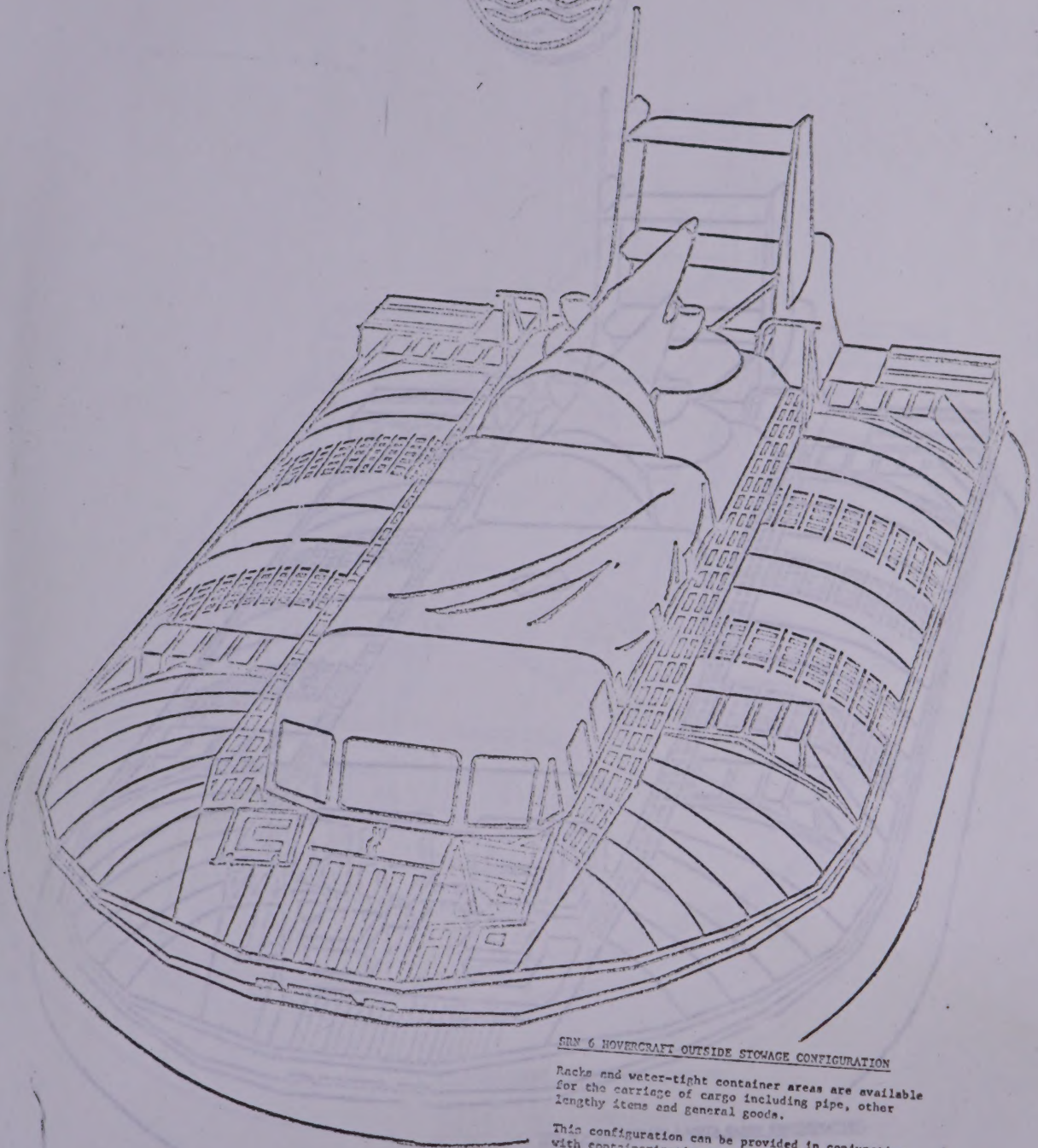
The charterer must provide room and board of an acceptable standard to Hovercraft crew members or in lieu of making facilities available pay the actual cost of room and board.

All charges set out above apply to any charter carried out north of the 60th parallel.

AVAILABILITY: Pacific Hovercraft Ltd. is presently the largest operator of Hovercraft in the world by number of units in service. SRN-6 craft are available within four months after a contract is let with earlier delivery for short term charters if a craft is operating in the region in question. More rapid placement of craft to a charter location is possible at some times.

SRN-5 craft are available within three months after a contract is let.

Availability is affected by the ferry and positioning required.

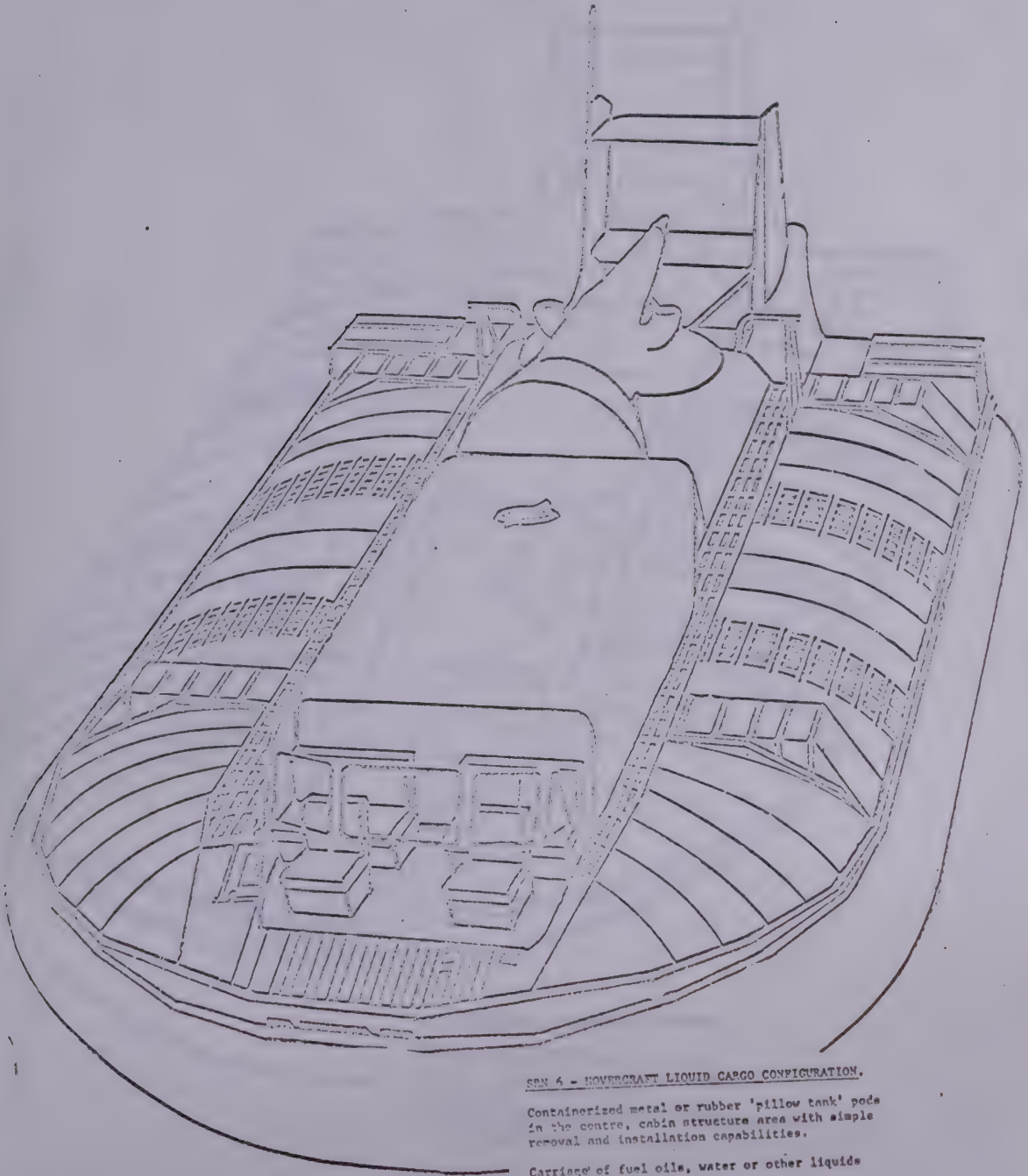
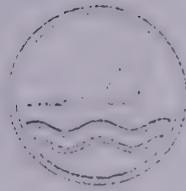


SRN 6 HOVERCRAFT OUTSIDE STOWAGE CONFIGURATION

Racks and water-tight container areas are available for the carriage of cargo including pipe, other lengthy items and general goods.

This configuration can be provided in conjunction with containerization and camping configurations.

Up to 25 passengers and internally stored cargo may also be carried.

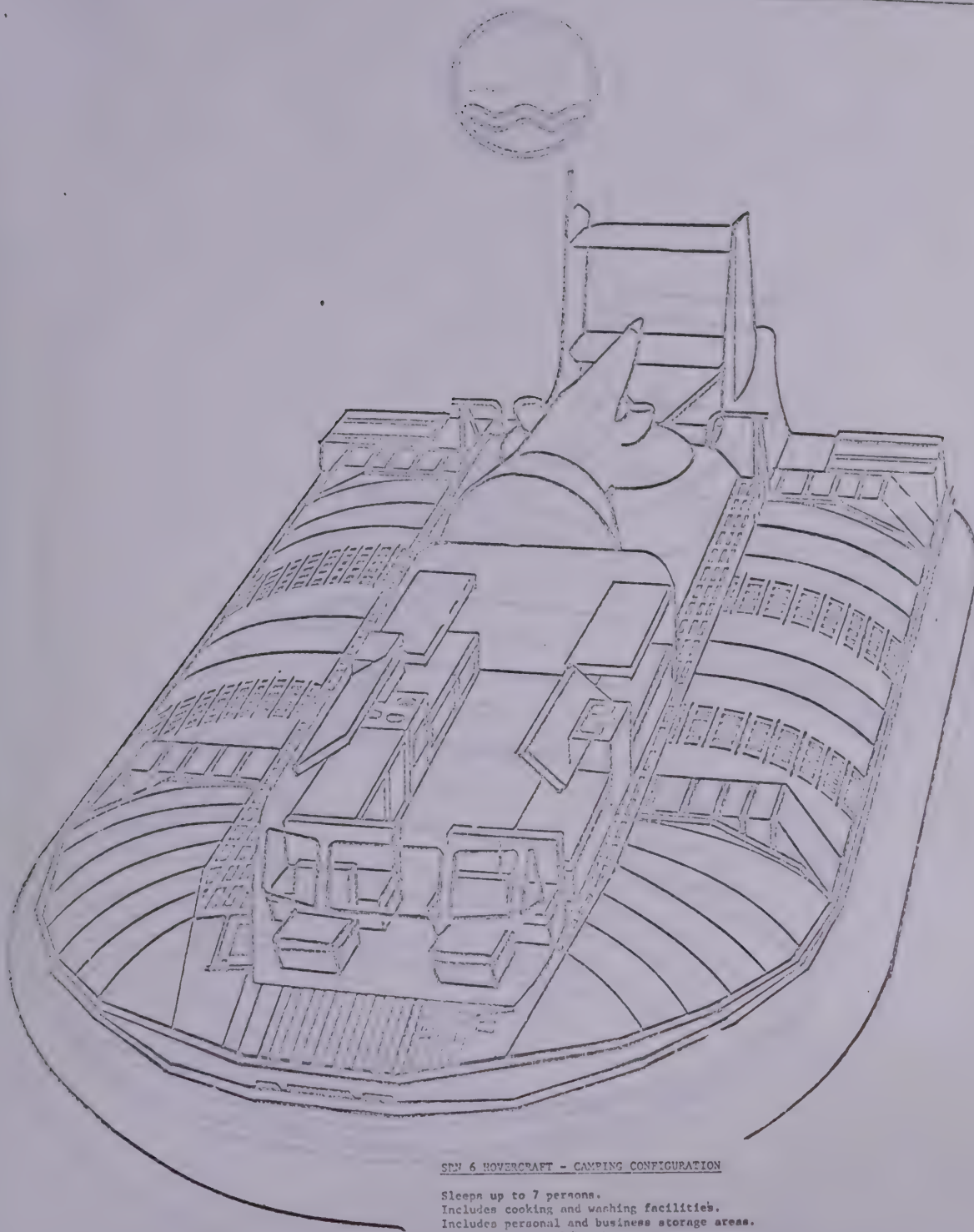


SEN 4 - HOVERCRAFT LIQUID CARGO CONFIGURATION.

Containerized metal or rubber 'pillow tank' pods in the centre, cabin structure area with simple removal and installation capabilities.

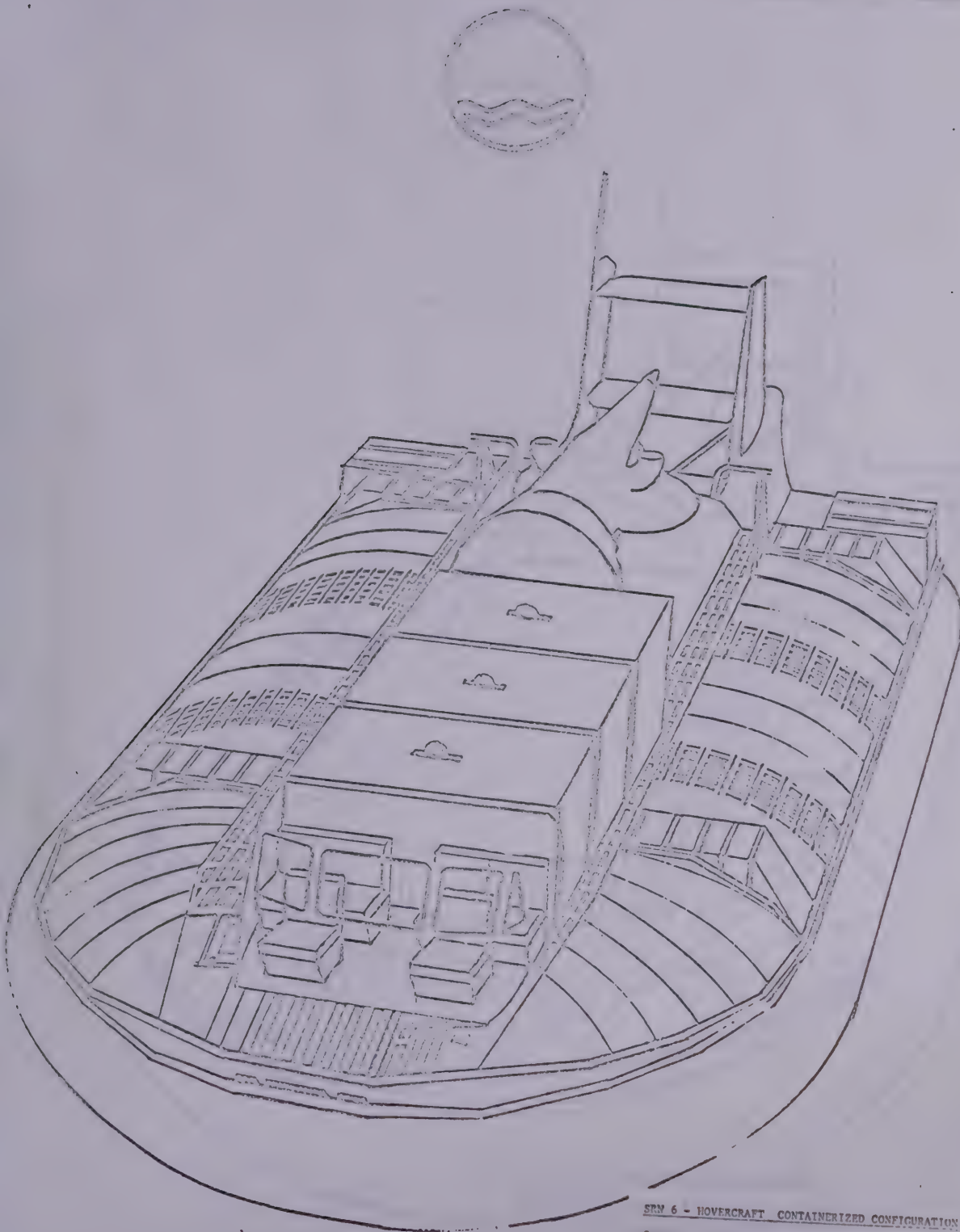
Carriage of fuel oils, water or other liquids is possible.

Sets five passengers and two crew.



SBN 6 HOVERCRAFT - CAMPING CONFIGURATION

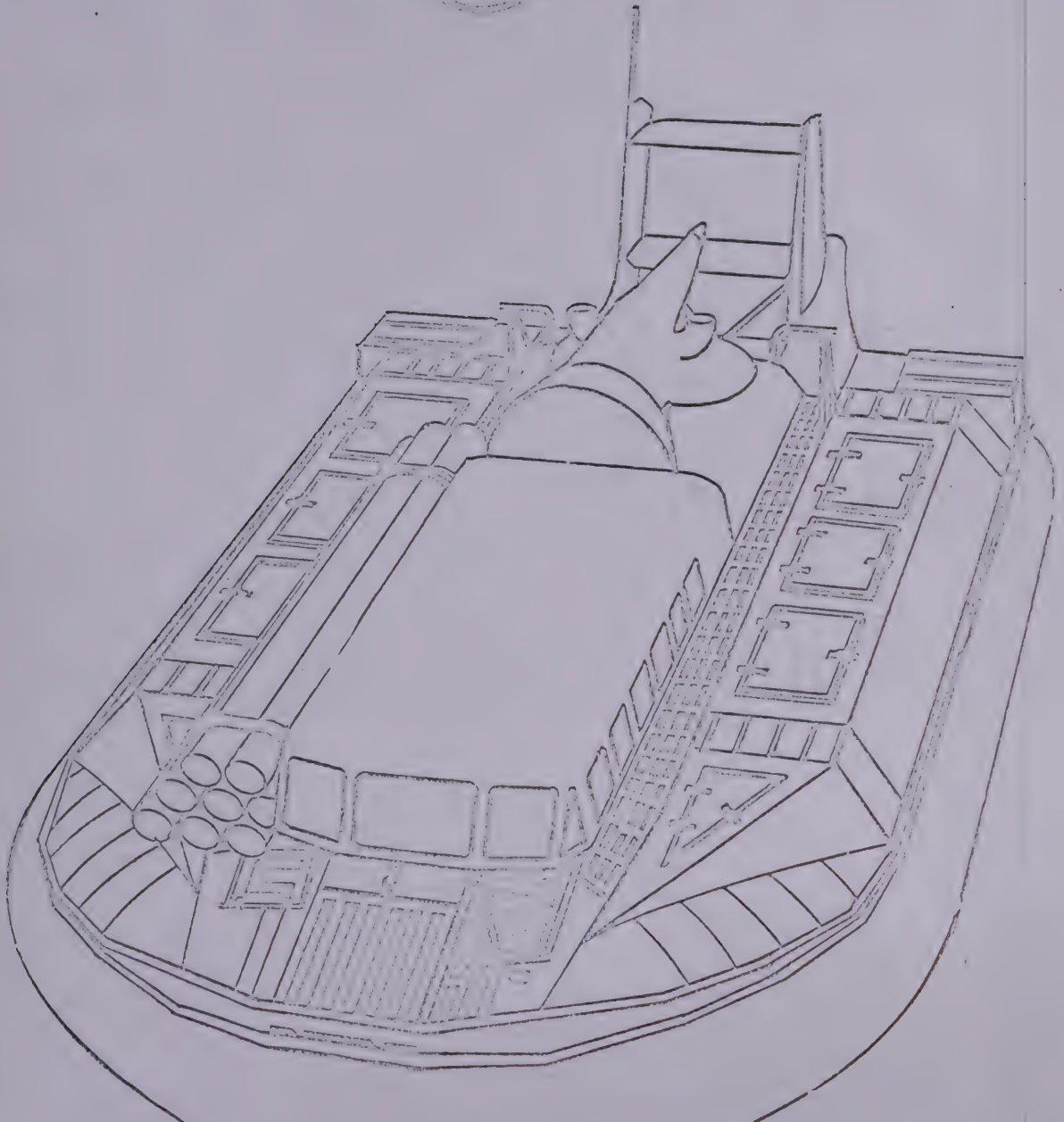
Sleeps up to 7 persons.
Includes cooking and washing facilities.
Includes personal and business storage areas.
Has a working deck/bench area .
Fully self contained for heat and power.
Associated toilet facilities carried with the craft
but erected outdoors.



SRN 6 - HOVERCRAFT CONTAINERIZED CONFIGURATION

Containerized cargo pods installed in the centre.
cabin structure area with sling attachments for
simple installation and removal.

Seats five passengers and two crew.



SRN 6 - HOVERCRAFT OPEN CARGO CONFIGURATION

Open storage area with fabric or metal, readily removable cover to allow the stowage of cargo too large to move through the front entrance door.

Seats five passengers and two crew.

PROBLEMS

Air cushion vehicle

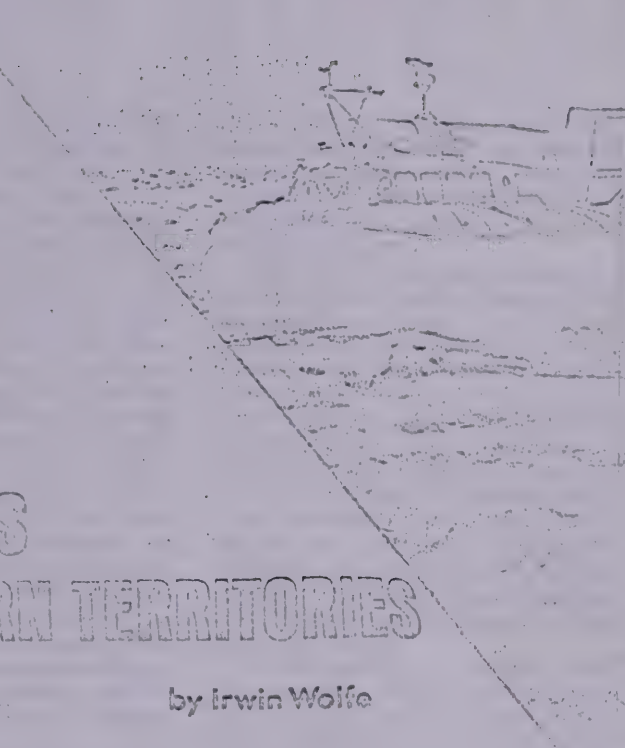
By *Wm. Solomon*

TTAWA—Resource companies anxious to probe for natural wealth along Canada's arctic continental shelf may get some spurs sooner than expected.

The reason: a novel way has been found to speed up hydro-

graphic or depth-sounding surveys in ice-infested waters. An air cushion vehicle, a newly designed, retrofitted depth-sensing system with the Beaufort Sea this summer at speeds up to 50 mph.

The marriage of hydro- and sounding system was



OPENING UP CANADA'S NORTHERN TERRITORIES

by Irwin Wolfe

DOES the Canadian Government possess a fortune in its North, or does it possess a million-and-a-half square miles of frozen, useless geography located at the top of the world?

The experts are betting that Canada's northland can become truly wealthy by exploiting the vast resources lying beneath the northern surface. Rich oil reserves lie beneath Cornwallis Island, Bathurst Island and the Mackenzie River district. Because of today's poor transportation, however, it is only feasible now to mine areas in the southern strip of the territories, where they border the provinces.

Recent improvements to existing modes of transport, and the development of a new mode—the air cushion vehicle—have set a good many Canadians to wondering just where Canada goes from here with its northland.

The C-130 or Hercules aircraft is now in regular supply operations in the North with the Royal Canadian Air Force. Snowmobiles are in more frequent use, even by the Eskimo. Another step forward was taken last year. Canada staged two trials of ACVs, one at Tuktoyaktuk and on the Mackenzie River, the other at Trenton, Ont.

Concerning the use of ACVs, we

still hear the objection, "It's not economical." But since when has Canada instituted and maintained transport routes only when it was economical to do so? John Jenness of the Department of Northern Affairs & National Resources told the Canadian Association of Geographers: "In a sense, the situation there (the north) today is much the same as it was farther south a century ago, when rail builders possessed the daring and foresight to lead settlement into the Prairie Provinces; for the north is presenting us with the same risk of high costs and obscure markets that faced us in those days on the Prairies."

There is solid justification for the practice of the Canadian Government subsidizing transport routes essential to Canada's welfare. No other country in the world has so small a population (20 million) scattered over so wide an area. One estimate is that Canada could usefully employ 25 to 30 ACVs within the next 10 years.

The trials at Tuktoyaktuk (called "Tuk Tuk" from here on) took place

from April 22 to May 30, 1966, as the winter ice cover was breaking up. They were mainly at Tuk Tuk and vicinity, over the fast ice in Kugmallit Bay (at the southern coast of the Arctic Ocean or Beaufort Sea), and 450 to 500 miles along the Mackenzie River from near its gulf to the village of Norman Wells. Temperatures ranged from -24° F to 60° F.

The Canada Defense Research Board's report on the Tuk Tuk trials indicates that the ACV is at home in the Mackenzie River area. This is significant because the types of ice and snow correspond to those in much of northern Canada. The ACVs took in stride regions of flat ice with drifts of wind-packed snow; rough first-year ice, and pressure ridges. The steepest slope cleared, in Tuk Tuk harbor, was 17 feet high and was negotiated successfully at an approach speed of 25 knots.

Drawing upon the experience at Tuk Tuk, it can be assumed that the ACV would operate successfully over large areas of the north. Undoubtedly there are physical obstacles. A few of the off-shore ice pressure ridges might prove too massive for today's ACVs. The wrecker's ball might be the only way through. One source suggests maintaining a right-of-way onto the beach, just as airport runways are plowed after a snowstorm. In the long run, however, many of these obstacles can be overcome by simply building bigger machines with longer skirts. Bell Aerosystems, for example, says it will soon be making ACVs with skirts 8 feet high, and that in a few years it will be turning out ACVs 150 feet long, supported by skirts 10 to 12 feet high. The longer skirts, combined with improved radar and well-mapped ACV "snow lanes" in the more treacherous areas, will widen the portions of the north which future ACVs will be able to traverse.

Canada's far north transit routes are hardly impressive. Canada's only Arctic river of consequence, the Mackenzie, is also the only one in the north that is navigable and connects with the rail transportation system of the Canadian interior. That point is being driven home with increased force these days as

activity booms in the Pine Point mines near the southern shore of Great Slave Lake. Last year they shipped 900,000 tons of ore.

The Great Slave Lake Railway, built two years ago, now makes it possible to move supplies by rail northward from the Canadian Provinces to the southern shore of Great Slave Lake. Here freight is transferred to barges for the run down the Mackenzie River, which has the lake as its source, and into the Arctic interior. But this barge transshipment is restricted to the summer months, and even then it is extremely inefficient, cumbersome and slow.

ACVs could make deliveries the year round, adding the dimension of speed to Mackenzie River transport. Ideally, cargo ACVs would run the full length of the Mackenzie. Making intermediate stops enroute, they would come up onto land and off-load cargo directly into settlement warehouses.

The Coast Guard—the seagoing fleet operated by the Marine Services of the Department of Transport—delivers annually about 100,000 tons of supplies to eastern Arctic ports for distribution to some 75 settlements and outposts. It must rely on ice-breakers, which are extremely inefficient as cargo carriers. Because of the ice, they get up to the Arctic late

—in July and August—and they must leave early, by the end of September or early October. Much of the tonnage has to be delivered to open beaches, where the ACV would be in its element.

One expert estimates an immediate two to three-fold increase in efficiency if the Coast Guard ships moved north with ACVs as tenders. They could leave southern ports earlier—May or June—and stay perhaps till November. Life at such East Arctic ports as Clyde, Pangnirtung and Pond Inlet would be a lot easier.

After finishing its supplies-beaching operation, an ACV could carry out ice and navigational aids reconnaissance. When through patrolling, the ACV would return to its mother ship and all would proceed to the next port of call.

C-130 aircraft, Otters, and Beavers, as well as VTOL and STOL aircraft, can all play very useful roles in the north. Yet they have their limitations. A C-130 can land at Resolute, for example, only during mid-winter. The ice is too thin to support such a big aircraft—or even Beavers and Otters—during spring and fall. What's more, landing conditions are often hazardous. With ACVs, supply operations could continue unhindered.

Limited trucking operations exist

In British Columbia—from Vancouver to Victoria and to Seattle.

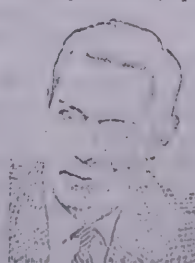
Patrolling is another good possibility. The Department of Transport is beginning a traffic control patrol between Montreal and Les Escoumains, which is about 40 miles down the St. Lawrence River. The Department must also maintain a pollution patrol. ACVs, because of their versatility, could do both and might also transport river pilots between ship and shore. During the winter, ACVs could conduct ice patrols in the Montreal harbor and in the shipping lanes leading from Montreal, especially those to Lake St. Peter.

Larger ACVs may be just the ticket for transporting crews and material to hydro-electric installations in northern Manitoba, in northern Quebec as at Manicouagan, and along the Aux Outardes River.

Production of ACVs capable of such service is expected to be under way soon in Bell Aerosystems' plant near Niagara Falls, where tools and an assembly line are being set up. Until now, virtually all of the testing and experimentation in Canada has been with the British Hovercraft's SR-N5 or its Bell Aerosystems equivalent, the SK-5. The new production facilities of Bell Aerosystems are scheduled to turn out a commercial model of the SK-5; a larger SK-6, capable of carrying 38 passengers, and the SK-9, a 25-ton craft which can transport 91 persons or 12 tons of payload.

With such a variety of models, appropriate craft will be available for most transportation needs envisioned for Canada in the near future.

Irwin Wolfe, 29, has gained close familiarity with Canada's prospects as an associate editor of "Canadian Transportation," published by Southam



Business Publications. An article on improving transportation in Northern Canada, which he wrote in December 1965, brought comment from Northern Affairs Minister Arthur Laing and Prime Minister Lester B. Pearson.

He holds a commercial pilot's license and has traveled extensively throughout his native country. Born in Montreal, he speaks English and French. Mr. Wolfe has also been an associate editor of Business Management Magazine. He resides in the New York City area now, but he has retained his Canadian citizenship and frequently returns to the area on which he has become an expert.



National Film Board of Canada Photo

in the northern territories. Trucks are employed, for instance, in the Yukon, in the Great Slave area, and to link the southern transportation systems with the Mackenzie River area.

The outlook for more roads in the north is not good. By and large, building conventional roads is prohibitively expensive. There has been a meager attempt to lay snow roads in the area between the Mackenzie River and Great Bear Lake. But they are used for the most part by soil exploration crews, travelling in tracked vehicles; the roads are not good enough for wheeled vehicles. Using ACVs could obviate most, if not all, of the difficulties.

There are many more potential uses for ACVs:

Law enforcement. The Royal Canadian Mounted Police today patrol the vast area by dog sleds, snowshoes, snowmobiles, aircraft of many types; ACVs would be extremely useful.

Medical. While on patrol, law officers equipped with ACVs would also function as police ambulance teams. As matters now stand, there are periods when medical help simply cannot get into settlements. Even when medical teams are parachuted into northern outposts, they must often remain there during thaw and early freeze because the ice cannot support the landing weight of aircraft.

Mail delivery. Service now is abysmally poor; there is virtually no scheduled transportation of any kind between Canada's east and west Arctic regions. The ACV can serve effectively as a sort of jitney bus to

feeder airlines while doubling as an alternate mail distributor.

Education. Canada's indigenous northern citizens—to a large extent Indian and Eskimo—can be taught to farm, serve as mechanics, and the like. ACVs could bring them to training centers. Likewise, their children could be sent to schools that would be well built, well equipped, and centrally located. Admittedly, students would have to live in for the duration of the term, but with ACVs it would be a lot simpler for northern authorities to see to it that children catch up with their nomadic parents.

Exploration. ACVs could put most northern exploration work on a 12-months-a-year basis. Mineral and scientific exploration work now must cease during break-up and freeze-up, when snow gets soft on land and no vehicles can move nor can any planes land. Field parties, for the most part, go idle, at great expense to the companies or government departments that send them in.

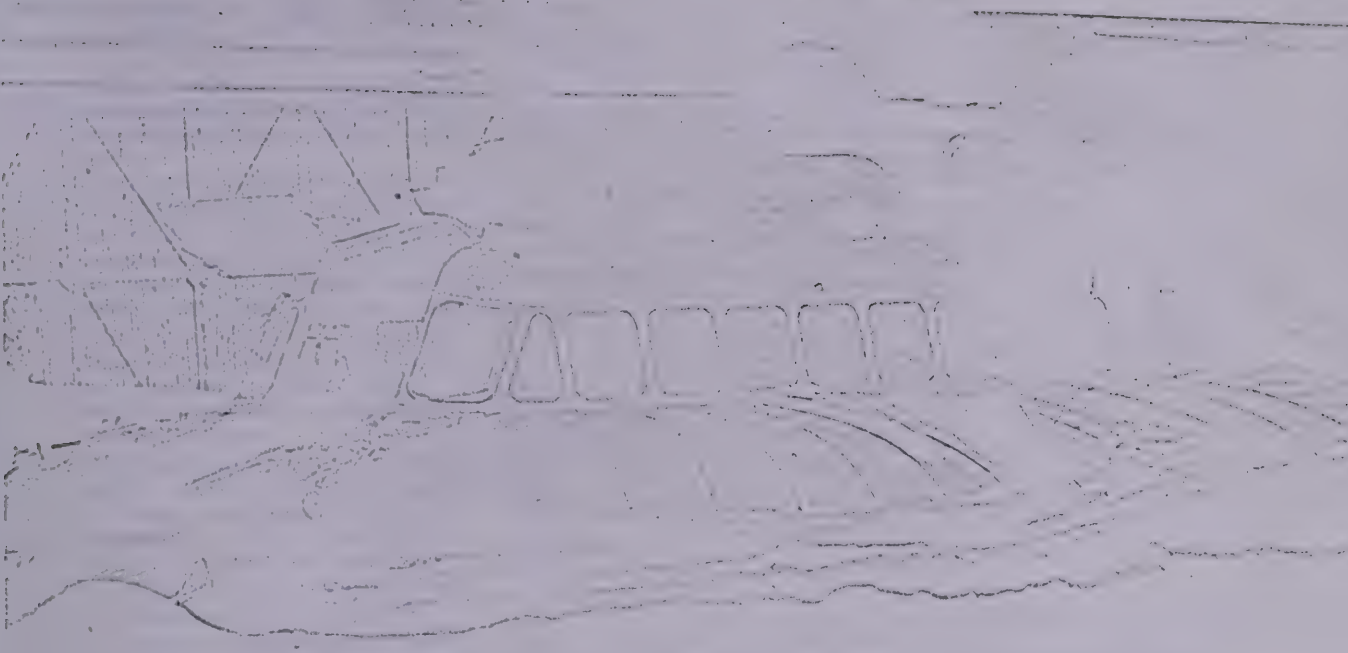
Efficient use could be made of ACVs in scientific forays involving hydrography (charting the ocean bottom), magnetic surveys (for keeping tabs on the magnetic storms causing radio blackouts all over the world), gravity surveys and seismological surveys. Typically, such teams must cover wide areas quickly, with only short stays in any location.

For some time now, thought has been given to using ACVs for surveys of the Polar Continental Shelf. The Department of Energy, Mines & Resources has about 40 men, almost all scientists, stationed at various

bases such as Mould Bay, Isaacson, Alert and Resolute. To supply and service them, the Government operates five helicopters and a few Otter and Beechcraft aircraft.

The report on the Tuk Tuk trials points out that the ACV "is ideally suited to many scientific roles. It could be used to ferry small parties and equipment between a central base and field locations up to about 50 nautical miles away. It could be used as a mobile laboratory complete with appropriate instruments installed in the craft. As such, the craft could travel across a variety of terrain types and stop as required to sample data. It would not be necessary to shut down the engine unless the craft were to be stopped for periods longer than, say, 15 minutes. The space available in, and payload of, the craft would allow supplies for a small number of people for several days to be carried, as well as a reasonable amount of scientific equipment."

Better transportation, for any of a dozen purposes, is one of the area's most pressing needs. ACVs can abolish or overcome much of the isolation now an inescapable part of living "up North." The revolutionary new craft can bring reliable mail and medical service, serve as bus routes feeding air stops, and make possible schools that are better equipped and easier to reach. With these improvements, who knows, more people may actually move northward. Even if they don't, life could be a lot easier for those 50,000 or so Canadians who now make the northlands their home. □



MAINTENANCE is one of the areas where costs must be closely watched in Hovercraft operations.

Hovercraft tests continue

Passenger services planned

By Steve Duncan

CHURCHILL, Manitoba — As a high-speed method of moving people and goods across Canada's barren northland, air-cushion vehicles are unbeatable.

That's the private evaluation of a senior Canadian armed-forces officer who has spent two months testing an SRN-6 Hovercraft for the federal government near this desolate sub-Arctic outpost. During that time, the Hovercraft has been run in temperatures as low as minus 41 F and at speeds up to 50 mph over powder snow, ice and open water. It had no mechanical failures.

Although no one is prepared at this time to say ACVs are the key to opening the north, the official report on the low-temperature trials — available when all data has been compiled — is expected to be highly favorable in its assessment of the craft's potential in remote areas. The success of these trials may also spur year-round commercial application in Canada's more populated southern areas.

The Churchill tests on the SRN-6

were sponsored by four government departments — Transport, Indian Affairs and Northern Development, the Defense Research Board and the National Research Council. Testing was under the direction of Capt. W. A. Jacobs, of the Land Engineering Test Establishment of the Defense Department, together with Hoverwork Canada Ltd., owners of the test craft. The SRN-6 was one of two Hovercraft which carried 366,000 passengers at Expo '67 last year; both were built by British Hovercraft Corp. After Expo closed, the \$500,000 machine was partially dismantled, then shipped by rail to Churchill.

For the Arctic trials, the SRN-6 was stripped of its luxury equipment and fitted with radar, extra fuel drums and a powerful interior heater. Also included was a survival kit for its seven-man crew, in case the machine broke down far from the Churchill base. Thus equipped, and powered by a 900-hp Bristol Siddeley Marine Gnome gas turbine engine, the test vehicle has a top speed of 50-60 mph and a cruising range of 250 miles. Payload (depending on the amount of fuel being carried) is between 6,800 and 13,000 lb. There is no air-worthiness problem with overloading. Extra

weight absorbs more power in lift, leaving less for forward propulsion.

The craft has an overall length of 48 ft, overall beam of 23 ft, and overall height of 15 ft. In normal service, it would carry 38 passengers. It can negotiate obstacles up to 6-ft in height and climb a 1:9 gradient from a standing start.

How well does the Hovercraft operate in this sub-Arctic climate?

Capt. Jacobs, responsible for all technical aspects of the Churchill trials, said: "it's unbeatable". To prove this contention, Jacobs took a group of government officials and other observers on test runs across the frozen surface of Hudson Bay. Even to those who had been aboard the same craft at Expo, the trip was an intriguing experience. On the long fast run over Hudson Bay, the SRN-6 glided smoothly over ice jams that appeared about five feet high.

Back on the mainland, the operator sent it charging over deep powder-snow drifts and picked a path through the scrub timber that surrounded Churchill. There was no apparent handling problem when the craft moved from ice to powder snow. Despite an approaching whiteout condition caused by high winds that day, visibility

ty remained good. This did not mean the Hovercraft was flawless. At a briefing prior to the test run, Jacobs listed a number of areas where improvement would be needed before the machine could be pressed into regular service.

The two big problem areas, he said, were handling and navigation. The SRN-6 was difficult to slow down (normally accomplished by reversing the pitch on the propeller) and its manoeuvrability was poor. Hoverwork Canada's president, A. B. German, suggested that some of these braking and handling problems could be solved by experimenting with different types of propellers.

Navigation problems are caused more by northern terrain and weather than equipment design. The craft is equipped with radar for avoiding obstacles during Arctic whiteouts but, in barren Arctic regions, was ineffective as a primary source of navigation.

The Hovercraft also proved expensive to operate — about \$250 an hour according to German. However, this must be balanced against the cost of operating aircraft and helicopters, traditional forms of transport in the north. It was also in the Hovercraft's favor, that the machine didn't need costly airfields and it had greater lift capacity than helicopters.

Operation over open water when temperatures were below freezing did not present the anticipated icing problems. The Hovercraft operated for a day over open water during $\pm 17^{\circ}\text{F}$ weather and during this time about 3/32 in. of lightweight spongy ice built up on the skirts. According to Jacobs, this ice buildup was not serious enough to interrupt the craft's operation.

A detailed report on the SRN-6 low-temperature trials will be compiled in the next few months from data collected at Churchill. This report eventually will be made available to any commercial interest wishing to explore the machine's operational characteristics. In the meantime, the success of the Churchill trials is leading to a spate of speculation on how air-cushion vehicles can be applied to uniquely Canadian transportation problems.

Government authorities concerned with northern development see ACVs playing a survey and supply role in isolated areas. Churchill, with its rail link to Winnipeg is in an ideal location for supplying a number of small communities around Hudson Bay, and is also a good base for survey work.

Rivers — frozen or open, can provide natural routes for ACVs in the north, as one Canadian company will



PLOUGHING THROUGH rough terrain, the Hovercraft handles with ease.

set out to prove this summer. Pacific Hovercraft Ltd., Richmond, B.C., has proposed a year-round service along the MacKenzie River, operating out of Hay River, a Northern Alberta Railway terminal, and into the Northwest Territories.

Commercial applications of ACVs in populated southern areas are almost unlimited. One Transport Department researcher at the Churchill trials predicted they could be pressed into commercial service as passenger-carrying ferries on the Northumberland Strait and across the Bay of Fundy. This plan would leave existing ferries free to carry railway cars and freight, with ACVs providing high-speed passenger service.

Another possibility is a passenger service between Toronto and Rochester, N.Y., a distance of about 75 miles across Lake Ontario. Passengers would leave from downtown Toronto, arriving at downtown Rochester an hour and 15 minutes later, a service airlines would be hard pressed to match.

In view of these future uses for ACVs, the Churchill low-temperature performance trials on the SRN-6 have great significance. But can air-cushion vehicles provide an economical solution to Canada's transportation problems? The federal government, intrigued by the potential of go-anywhere ACVs has launched a joint government-industry study to find out.

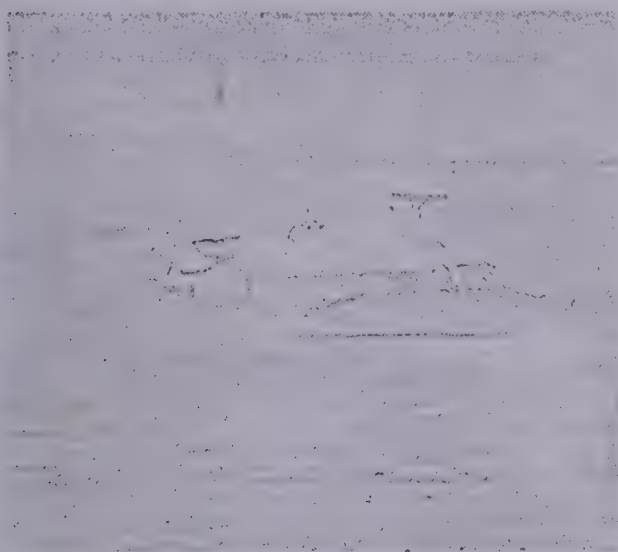
Under direction of the National Research Council, a group of private companies and federal government

agencies, representing operators, users and manufacturers, will take a detailed look at the role of ACVs in Canada. Phase one of the two-part study involves approaching a large number of transportation firms and users to determine if they have problems that can be solved through application of air-cushion principles. This part of the study is also expected to decide what types of ACVs are best suited for the various types of Canadian terrain. The possibility of manufacturing air cushion vehicles in Canada is also being studied.

If Canada does get involved in marketing Canadian-designed and/or manufactured ACVs, it will find the competition stiff. Britain, France and the U.S. have been involved in ACV development for about eight years and have a good deal of design and engineering experience in this field. In the face of this competition, Canada's success will probably depend on developing specialized forms of ACVs, according to NRC's Dr. D. C. MacPhail, director mechanical engineering division.

"The British have concentrated on higher and higher speeds over water and the U.S. has emphasized military requirements. The French have worked on military projects and some overland. But we have areas where speed isn't so important, where the mere ability to move goods at all is an achievement. Not much work has been done in this field and it might be the answer for Canada," said Dr. MacPhail. END

Hovercraft Ferry Speeds B. C. Riders At 60 Miles an Hour



B. C. HOVERCRAFT UNDER WAY

By DICK LARSEN
Times Staff Reporter

VANCOUVER, B. C. — The orange, bug-like craft rises slightly from a barge moored on Vancouver's waterfront and, spewing a flat, white wake, skims across the harbor.

It accelerates to nearly 60 miles an hour as it darts under the Lions Gate Bridge, out toward the Strait of Georgia.

Meanwhile, all else in the harbor — the ferry plowing toward its berth, the freighters easing across the harbor, the laboring tugs — seem in contrast to "freeze" into super-slow motion.

Thus, the Hovercraft era has arrived here.

The "bug," 48 feet long, skims on its own cushion of air, about four feet off the water's surface.

It is the first regular passenger ferry on this continent using the Hovercraft principle. It began service in February, making the 34-mile run (68 miles round trip) twice daily between Vancouver and Nanaimo, on Vancouver Island.

It can whisk up to 33 passengers across the Strait in less than 50 minutes.

THUS FAR the success of the run has been "far above what we had expected . . . just excellent," said Barry Jones, president of Pacific Hovercraft, Ltd., the operator.

The craft has performed at the speeds it was reputed to have — to 60 miles an hour and faster. Driftwood is no problem, Jones said, because the craft and its air cushion ride right over stray logs.

The Hovercraft's use has been greater than expected in its first weeks and is growing.

Just about everything about it is novel. It may, for example, be the only ferry to have had a dry-land collision with a truck. (The truck, amidst a crowd of curiosity seekers around the craft, crunched into it. Damage was slight.)

It is not technically a boat, because it doesn't ride in the water. Nor is it really an aircraft, although it rides on an air

A RIDE on the Hovercraft is a fascinating experience — like a blend of Greyhound bus and jetliner, plus a dash of seaspray.

The compact interior is brightly done in tan, trimmed in orange. It resembles a new bus. But the pretty blonde hostess, in an attractive uniform, is precisely like a jet stewardess — except her skirt is much mini-er.

"Welcome aboard Pacific Hovercraft's Time-shaver service," she says. Her short speech over the speaker sounds much like that aboard an airliner before takeoff. However, she makes no mention of buckling seatbelts. There are no seatbelts.

The engine roars, props whirl, and there is a barely perceptible feeling of rising as the craft lifts off its barge. It backs out over the water, turns with good maneuverability, then heads across the harbor.

Watching the surface skim by is like the ground rush during a jet takeoff. The ride is comparable with that of a bus on a slightly-bumpy road.

THE CRAFT makes a "wet" landing at Nanaimo, simply by cutting off its power and drifting to a stop at its dock. But at Vancouver it makes its "dry" landing: It drifts on its air cushion from the water onto its barge, and settles down much like a helicopter.

The hostess, with semantic skill, says over the P. A. system, "Thank you for hovering with us. We hope to see you again very soon."

Passengers debark, beaming, ready to tell everyone about their trip. Most of the first passengers have been curiosity seekers, but, said Jones, "we're beginning to get more and more businessmen."

"Nanaimo," he added, "is the hub to all the island's transportation and economic and industrial activity—particularly the forest industry."

One-way fare on the Hovercraft is \$7. Round-trip is \$14. The ferry cost is \$2.95 one way, \$5 round trip.

But, said Jones, the Hovercraft should really be competitively compared with air travel. A light plane hop to Nanaimo costs \$9, or \$18 round-trip.

"Time is the factor," Jones said. Hovercraft, from downtown to downtown, is as fast or faster than a plane. The ferry ride requires almost two hours.

THUS FAR weather has not been a major problem. Two Hovercraft runs were canceled last week for the first time by winds which whipped up chopping waves. "We could still run," explained Jones, "but it becomes uncomfortable for passengers."

Winds of up to 30 knots, the prevailing northerlies down the strait, are not a problem, he said. Those winds cause longer waves and the hovercraft can tack, finding the smooth troughs.

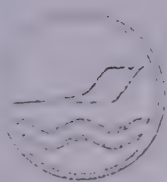
But winds out of the east set up a shorter, stiffer chop and a far-bumpier ride. Easterlies reaching 25 to 30 knots make operations marginal.

To Jones and his colleagues, there is no doubt that the Hovercraft era is here. They talk about other water runs and charter service for transportation-hungry industry in Canada's interior.

TWO MORE models of the present Hovercraft — the SRN-6 — are on order. They are British-made. The first is due next month, the second in May. The first will operate scheduled service between Vancouver and Victoria, Jones said. The other is for charter service.

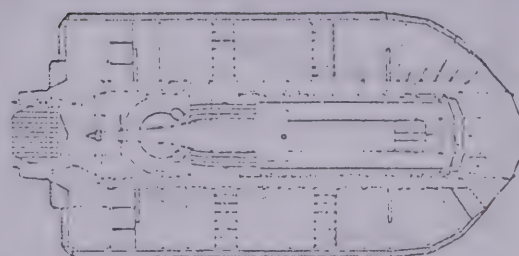
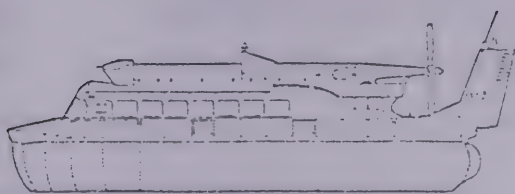
Each of those costs upwards of \$400,000. Pacific Hovercraft has an option on the bigger BH-7, costing approximately \$1.3 million. It can haul 120 to 130 passengers and five cars. The company also is eyeing the jumbo SRN-4, which holds 280 passengers and 20 cars.

Jones says of the air-cushion vehicle, "It is truly the answer if you have the right place (for passenger volume and environment (winds and water). Puget Sound is the ideal environment."



Pacific Hovercraft Ltd.

1045 West Pender St. Vancouver 1, B.C. Canada 689-7535



SR.N6

The SR.N6 is a high-performance overwater passenger ferry hovercraft employing a single engine, lift fan and propeller and is currently in full scale production.

Incorporated into its design are many of the fully-developed systems and components used in the highly successful SR.N5. This extensive use of proven components coupled with the increased payload capability (achieved without an increase in installed power), has resulted in improved operating economics.

Designed primarily as a passenger transport, the SR.N6 can accommodate 38 passengers in its roomy cabin which can be readily adapted to carry an alternative load of 3 tons of freight.

Power for its integrated lift/propulsion system is provided by a Bristol Siddeley 'Marine Gnome' BS GN 1051 gas turbine engine with a maximum continuous rating of 900 s.h.p. in calm seas, the SR.N6 has a maximum cruising speed of up to 56 knots. At reduced speeds, it can operate in waves up to at least 5 ft. in height.

Being truly amphibious, it can operate from relatively unsophisticated bases situated above the high-water mark, irrespective of the state of the tide and the depth of the water. Directional control is achieved by two rudders and all-moving tail-planes incorporated in the twin fixed fin assembly, plus an auxiliary air porting system. Manoeuvrability is further improved by a 'lifting' system fitted to the flexible skirts.

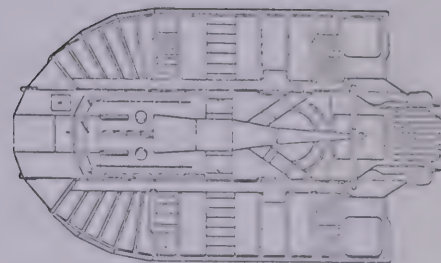
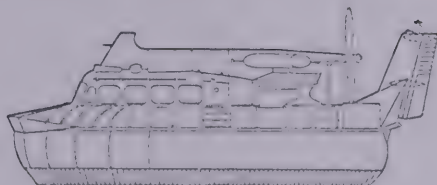
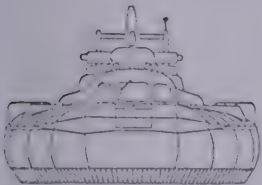
During 1965 a number of SR.N6's were introduced on passenger ferry services in Scandinavia and United Kingdom. Further services were launched during 1966 including two across the English Channel.

LEADING PARTICULARS

	DIMENSIONS
Overall length	48' 5" (14.76 m.)
Overall beam	23' (7.01 m.)
Overall height on landing pads	15' (4.57 m.)
Cabin size (length x beam)	21' 9" x 7' 8" (6.62 m. x 2.34 m.)
Cabin floor area	166 sq. ft. (15.42 sq. m.)
Door aperture size (height x width)	5' 9" x 3' 3" (1.75 m. x 0.90 m.)
Skirt length	4' (1.22 m.)
	POWER PLANT AND SYSTEMS
Engine	Bristol Siddeley 'Marine Gnome' 1051
Max. continuous rating at 15°c	900 s.h.p.
Propeller	Dowty Rotol, 4-blade, variable pitch, 9 ft. dia. (2.74 m.)
Lift fan	BHC centrifugal 7 ft. dia. (2.13 m.)
Fuel capacity	265 Imp. gall. (1,205 litres)
	WEIGHTS
Normal gross weight	8.9 tons (9.1 tonnes)
Max. gross weight	10.3 tons (10.5 tonnes)
	PERFORMANCE (at 17 300 lb. operating weight (7,847 kg) at 15°c)
Maximum speed over calm water (max. power)	60 knots (111 km/hr)
Maximum speed over calm water (max. cont. power)	56 knots (105 km/hr)
Speed in 4-5 ft. waves	45-55 knots (83-102 km/hr)
Still air range	200 n. miles (370 km)

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The Warden is a small high-performance hovercraft with a wide range of applications. It was the first hovercraft to be put into quantity production in the world and in advance of orders. Since production commenced orders have been received from the United States, Japan, Brunei and the United Kingdom.

Weighing 7 tons and capable of carrying 18 passengers or 2 tons of freight, the Warden design is based on a 15-inch deep buoyancy tank, sub-divided into watertight compartments. The cabin, positioned forward, is set into the plenum chamber and buoyancy tank. Easy access to the cabin is by a bow-loading door.

Power for propulsion and the air cushion lift is provided by a Rolls-Royce 'Marine Gnome' engine which is situated aft of the cabin. By a simple mechanical system, the engine is coupled to a single lifting fan and a variable pitch propeller. Control of the craft is by rudders and elevators mounted on the twin fin/tailplane unit, which operates in the propeller slipstream. A skirt lifting system is also provided to give extra control, particularly at low speeds.

Fitted with 4-ft. skirts the Warden has an outstanding rough country and overwave performance. Its amphibious capabilities enable the craft to operate over ice, sand and mud flats and debris strewn waters. It is a particularly attractive vehicle for military duties, where its excellent power-to-weight ratio gives it exceptional operational adaptability. The Warden is being operated by the British Military Services and the U.S. Navy.

LEADING PARTICULARS

DIMENSIONS

Overall length	38' 9" (11.78 m.)
Overall beam	23' (7.01 m.)
Overall height on pads	12' 11" (3.90 m.)

POWER PLANT AND SYSTEMS

Engine	One Rolls-Royce Marine 'Gnome' engine 900 s.h.p. max. cont. power
Propeller	Dowty Rotol 4-blade variable pitch, 9' diameter (2.74 m.)
Lift fan	BHC centrifugal 7' dia. (2.13 m.)
Fuel capacity	265 Imp. gall. (1205 litres)

WEIGHT

Normal gross weight	6.7 tons
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PERFORMANCE at normal gross weight at 15°C

Maximum waterspeed over calm water, zero wind, max. cont. power	60 knots (111 km./hr.)
Average service waterspeed	33-40 knots (61-74 km./hr.)
Endurance at max. cont. power rating on 265 Imp. gall. fuel	3.6 hours

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british hovercraft corporation
FAST CRAFTS - ISLE OF WIGHT - ENGLAND





WHAT IS A HOVERCRAFT?

A hovercraft is an air-cushioned vehicle. That means that it glides along on its own cushion of air, completely free of the ground. For this reason it is an amphibious craft and able to operate over land or water surfaces. Pacific Hovercraft Ltd. operates the SR-N6 hovercraft on its routes from Vancouver to Vancouver Island.

The SR-N6 is a fast over-water transport also operating on scheduled passenger carrying routes

in England, including a service across the English Channel, and on specialized operations at other world locations. This craft can be adapted to a variety of roles other than for passenger services.

Pacific Hovercraft Ltd.'s SR-N6 craft will provide a comfortable ride for 36 passengers at 50 miles per hour in 4 and 5 foot sea conditions. In calmer conditions a maximum speed of 60 miles per hour can be attained with a full load.

THE FUTURE OF THE HOVERCRAFT

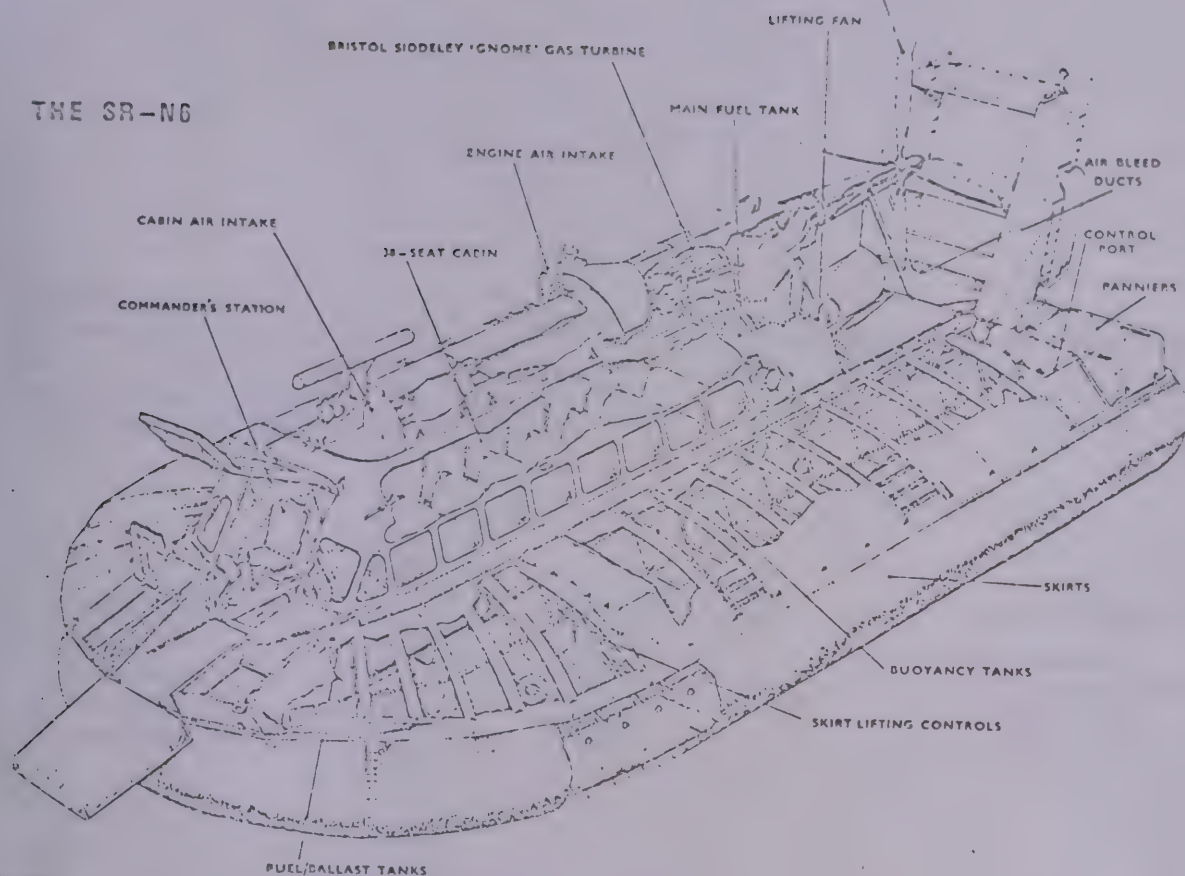
Hovercraft are rapidly establishing themselves as an advantageous form of transport throughout the world. Several commercial services are provided in England at the present time, one of them operating across the English Channel with an 185 ton SR-N4 craft. The large SR-N4 is the first of the ocean-going hovercraft, for which an exceptionally bright future is foreseen. Pacific Hovercraft Ltd. will be introducing services with an SR-N4 in 1971. The load configuration which will be used will allow the carriage of 30 automobiles

Pacific Hovercraft Ltd. will continue the development of new routes and utilizations in coastal regions of B. C. in conjunction with the scheduled services between the cities of Vancouver and Victoria/Nanaimo. New continued development of charter services in Arctic and sub-Arctic regions is being carried on and the potential of hovercraft in such areas is considered extensive. Federal government studies have been carried out and the use of air-cushioned vehicles in Northern Canada is expected to revolutionize transport systems and aid the development of these remote regions.



DOWTY ROTOL REVERSIBLE PITCH PROPELLER

THE SR-N6



THE SR-N6

The SR-N6 embodies' well-proven technical design which has already accumulated a substantial amount of operating experience in many parts of the world under vastly different conditions.

The basis of the craft is a 15 inch deep buoyancy tank subdivided into 12 watertight compartments. The cabin is set into the plenum chamber and the buoyancy tank. Access to the cabin is by a combined bow loading door & ramp. The wide dorsal hood on the cabin roof contains provision for air conditioning and cabin heating. The integrated lift/propulsion system employs a single gas turbine engine coupled to a centrifugal lift fan and a variable pitch propeller.

There are two gear boxes, an engine reduction gear box, and a propeller/fan bevel gear box. Basic notch control is achieved by two rudders

and all-moving tailplanes mounted on and between the twin fixed fins. Control ports, using plenum chamber air, further enhance yaw control. A system of "skirt lifting" incorporated in the craft provides a means of accurate maneuvering. The skirts of the SR-N6, which are characteristic of current hovercraft in production, permit appreciable obstacle clearance without excessive loss of pressurized air and without the need for large volumes of air. They give you a comfortable ride, "ironing out" waves and acting as a very effective suspension system.

The SR-N6 is entirely safe if the engine fails because the hull is largely made up of sealed air tanks. It has a record of many thousands of hours of reliable operation. In the unlikely event of an engine breakdown, the craft just floats.

PACIFIC HOVERCRAFT LTD



ABOUT SCHEDULED SERVICES

Pacific Hovercraft Ltd. is licensed by the Canadian Transport Commission to provide scheduled route service between the cities of Vancouver and Victoria and the cities of Vancouver and Nanaimo.

Terminal points are centrally located in the metropolitan area of each city.

ROUTE INFORMATION

	VANCOUVER/VICTORIA	VANCOUVER/NANAIMO
Travel Time	75 minutes	50 minutes
Route Distance	64 Statute miles	3.8 Statute Miles
One Way Fare	\$12.00	\$ 7.00
Same Day Return Fare	\$24.00	\$ 14.00

Freight pods are attached to the exterior of the hovercraft, which will allow light commercial freight carriage, passengers can carry small parcels or baggage on board. Ten seats are reserved on each

trip allowing business travellers the opportunity of assuring seat availability throughout the year, including the peak summer period.

OPERATING PERSONNEL

The SR-NS hovercraft are crewed by a Commander who is in charge of the craft and a Hostess/Radar Operator. Commanders are highly qualified, having marine, air, hydrofoil, and hovercraft operating experience. The Hostess/Radar Operators are fully trained as passenger service attendants and have completed a radar and radio operating training

course. During periods of low visibility and darkness, the Hostess will have a primary duty of a Radar surveillance operator. This will allow the service to provide continued fast service without restrictions normally associated with commercial transport systems as caused by the weather, or darkness.



PACIFIC HOVERCRAFT LTD

Date Due

NOV 28 '76			
MAR 5 '78			
MAR 15 '76			
MAR 24 '78			

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PACIFIC Hovercraft Ltd.
AUTHOR

The utilization of hovercraft in
TITLE
arctic and sub-arctic regions.

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SUMMARY

Hovercraft have been shown to offer effective transportation support in Arctic and Sub-Arctic regions. Movement of men, equipment, cargo and associated material can be carried on throughout the year over most forms of terrain. The craft can be effectively operated during periods of reduced visibility and during adverse weather conditions. It offers advantages as a marine and overland emergency vehicle.

The SRN-6 is considered to be the most effective type of Hovercraft for northern operations, when compared to the SRN-5. Its greater payload, passenger capacity and its higher performance offer benefits at a nominal additional charge.

The SRN-5 may be more desirable where physical size must be minimal. This smaller craft does not have the skirt height of the SRN-6 and therefore has 6 inches less clearance from the ground level. It is normally powered by the same engine as the SRN-6 and subsequently it may be able to do a more effective job because of added thrust which can be applied to some roles.

The SRN-6 has increased performance while using the same engine as the SRN-5 because of increased efficiency resulting from more effective skirt design and a larger cushion area. Some SRN-6 craft are available with a larger engine which produces an additional 200 horsepower resulting in uprated performance in all areas.

Pacific Hovercraft Ltd. is able to provide the most experienced Hovercraft crews available. Pilots include those previously active in arctic operations and engineers having extensive experience at various geographical locations. Full maintenance, personnel and associated service support is provided from the company's major overhaul and parts depot which supports scheduled service operations in the Southwest Coastal region of British Columbia as well as Northern charter activities.

0 1620 0336 7297